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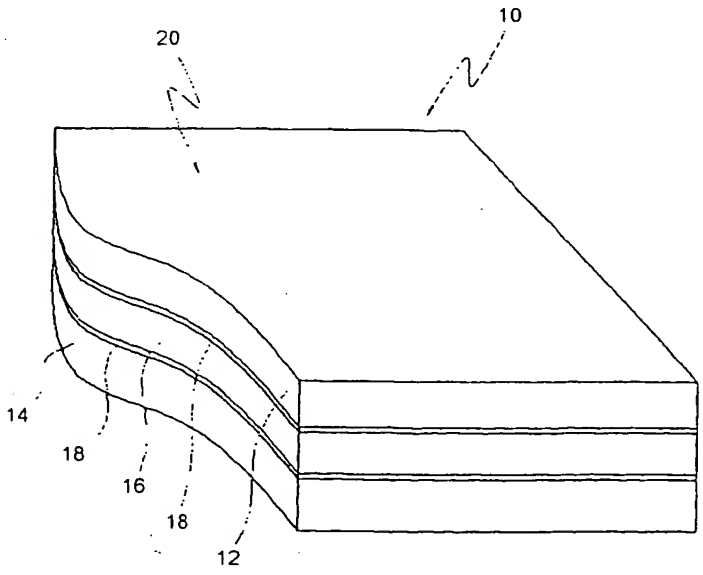
(54) Title: LAMINATED GLASS, AND METHOD OF AND APPARATUS FOR MANUFACTURING THE SAME



(57) Abstract: The present invention relates to laminated glass with a plastic intermediate material having adhesiveness interposed between and integrated with two or more glass sheets by pressurization, and a method and apparatus for manufacturing the laminated glass. The laminated glass according to the present invention includes a first glass sheet, a second glass sheet, and a plastic intermediate material interposed between the first and second glass sheets and press-bonded to the first and second sheets via coatings of adhesives formed on both sides of the intermediate material. A method for manufacturing laminated glass according to the present invention includes the steps of sequentially loading a first glass sheet and a second glass sheet on a conveyor belt; cleaning and drying the first and second glass sheets; lifting the first glass sheet by a fixing device at a predetermined location; bonding a plastic intermediate material with adhesives coated on both sides thereof to the second glass sheet carried by the conveyor belt and carrying it directly below the fixing device; lowering the fixing device and bonding the first glass sheet to an upper surface of the intermediate material bonded to the second glass sheet; and integrating the intermediate material with the first and second glass sheets by pressing the first and second glass sheets bonded via the intermediate material. According to the present invention, since the manufacturing process of the invention is performed at room temperature, the present invention remarkably reduces time required for the manufacturing process. In addition, the present invention is more compatible with the environment and cheaper. Furthermore, the ratio of stiffness to weight of the laminated glass of the invention is several times larger than that of the conventional bulletproof glass.

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LAMINATED GLASS, AND METHOD OF AND APPARATUS FOR MANUFACTURING THE SAME

Field of the Invention

The present invention relates to laminated glass, and a method and apparatus for manufacturing the laminated glass, and more particularly to laminated glass with a plastic intermediate material having adhesiveness interposed between and integrated with two or more glass sheets by pressurization, and a method and apparatus for manufacturing the laminated glass.

Background of the Invention

Glass for minimizing damage to a human body when broken is commonly referred to as safety glass, and there is a tendency for the market share of the safety glass to continuously increase in the worldwide market. In particular, an advanced country regulates the application of safety glass to all buildings by law. The safety glass includes reinforced glass, resin glass and laminated glass. The reinforced glass means glass which is formed by heating it at high temperature (600°C or more) and rapidly cooling it and may have a particle size of a half of a nail of a little finger upon breakage thereof to reduce damage to a human body. The reinforced glass is used for building materials such as a door through which many people frequently pass and automobile glass for protecting a passenger in an automobile.

However, since the reinforced glass can be manufactured only in requested sizes, it is difficult to mass-produce and recycle it. This results from the breakage of the reinforced glass simultaneous with the cutting of the reinforced glass in a predetermined size. Therefore, the size of the reinforced glass cannot be changed, so that the reinforced glass may be used only in an originally produced size.

The resin glass means glass wherein a liquid resin, which is bonded while being

international price of the raw material of PVB is also relatively high (3200 ~ 3500$/ton). In addition, since thermal bonding is used in the course of producing the laminated glass, the processing period required for the thermal bonding is lengthened, and thus, there is a drawback in that their productivity is lowered. That is, it is necessary to process an intermediate material under high temperature and pressure, which involves a long-time process. Thus, there is a problem that the number of times of production normally does not exceed eight (8) times per 24 hour operation a day.

Summary of the Invention

The present invention is to solve the above problem in the prior art. The object of the invention is to provide laminated glass which can be mass-produced in a desired size and is compatible with the environment, recyclable and cheap.

Another object of the invention is to provide laminated glass having superior stiffness relative to weight.

The further object of the invention is to provide a method and apparatus for manufacturing laminated glass, wherein the required processing period can be relatively shortened.

To achieve the aforementioned objects, laminated glass according to the present invention includes a first glass sheet, a second glass sheet, and a plastic intermediate material interposed between the first and second glass sheets and press-bonded to the first and second sheets via coatings of adhesives formed on both sides of the intermediate material.

Further, a method for manufacturing laminated glass according to the present invention includes the steps of sequentially loading a first glass sheet and a second glass sheet on a conveyor belt; cleaning and drying the first and second glass sheets; lifting the first glass sheet by a fixing device at a predetermined location; bonding a plastic intermediate material with adhesives coated on both sides thereof to the second glass sheet carried by the conveyor belt and carrying it directly below the fixing device;

be explained in detail with reference to the accompanying drawings.

Figure 1 is a sectional view of a portion of the laminated glass according to the present invention, and Figure 2 is an exploded perspective view of the laminated glass according to the present invention. As shown in the figures, the laminated glass (10) according to the present invention consists of a first glass sheet (12), a second glass sheet (14), and a plastic intermediate material (16) interposed between the first and second glass sheets (12, 14). The thickness of the glass sheets used for the present invention is about 2mm or more, and one side of each of the first and second glass sheets (12, 14) is bonded to adhesives (18) on both sides of the intermediate material (16), respectively. That is, the structure of the laminated glass (10) according to the present invention consists of the first glass sheet (12), the adhesive (18), the intermediate material (16), the adhesive (18) and the second glass sheet (14) in this order.

On the other hand, the thickness of the intermediate material (16) used for the present invention is 0.025mm or more, and a polymer can be used for the intermediate material. The polymer may include polyethylene terephthalate (PET), polyethylene (PE), polybutylene terephthalate (PBT), polyvinyl chloride (PVC), polyethylene naphthalate (PEN), ethylene vinyl acetate (EVA), polycarbonate (PC), polyvinyl alcohol (PVA), polypropylene (PP), Ionomer (IO), polymethylpentene (PMP), polystyrene (PS), polyvinylidene chloride (PVDC), polymethyl methacrylate (PMMA), ethylene vinyl alcohol (EVA), ethylene-acrylic acid (EAA), ethylene-methyl methacrylate (EMMA), ethylene-methyl acrylate (EMA), ethylene methacrylic acid (EMAA), ethylene-ethyl acrylate (EEA), poly acrylonitrile (PAN), polyphenylenesulfide (PPS), polyphenylene ether (PPE), polyestersulfone (PES), polyetheretherketone (PEEK), polytherimide (PEI), polyamide-imide (PAI), polyimide (PI), polymer alloy, cellophane, polyamide (PA), nylon, polyvinylbutyral (PVB), etc. The plastic intermediate material (16) of the present invention is made of a single sheet.

The coatings of the adhesives (18) are applied to both sides of the plastic intermediate material (16). The coatings of the adhesives (18) serve to couple the first

drying process station (58) follows the beginning process station (54). In the cleaning and drying process station (58), a foreign substance on surfaces of the first and second glass sheets (12, 14) is cleaned and removed and then a drying operation is performed for eliminating moisture remaining after the cleaning.

The bonding process station (60) follows the cleaning and drying process station (58). The bonding process station (60) is placed within a clean room (62). The clean room (62) is provided as facilities for preventing a foreign substance from sticking on the surfaces of the cleaned first and second glass sheets (12, 14).

A roll (64) for feeding the plastic intermediate material (16) is placed at an entrance of the bonding process station (60). The plastic intermediate material (16) is fed with the coating of the adhesive covered on each of surfaces thereof, and each of surfaces of the coatings of the adhesives is covered with a release paper. The release paper is peeled off by peelers constructed by rollers (72, 74) which will be described later. The peelers consist of a first peeler and a second peeler. The first peeler placed adjacent to the roller (72) peels off the release paper attached to a first surface of the plastic intermediate material (16), and the second peeler peels off the release paper attached to a second surface of the plastic intermediate material (16). The first peeler includes the roller (72) and the second peeler includes the roller (74).

The plastic intermediate material (16) with the adhesives (18) and the release papers attached thereto is wound on the roll (64). The plastic intermediate material (16) with the adhesives (18) and the release papers attached thereto passes along guide rollers (66, 68).

A fixing device (70) for lifting the first glass sheet (12) is also disposed within in the bonding process station (60). The roller (72) is placed downstream of the guide roller (68) and peels off the release paper with which one side surface of the plastic intermediate material (16) is covered. The other roller (74) for peeling off the release paper with which the other side surface of the plastic intermediate material (16) is covered is placed upstream of rollers (76, 78) which are a final portion of the bonding process station (60). A roller (73) is placed below the guide roller (68) and serves to

the glass sheets, as described later.

After the cleaning and drying process, the first and second glass sheets (12, 14) enter the clean room (62) within the bonding process station (60) and are bonded with each other. The first glass sheet (12) passes through between the rollers (68, 73), stops once it reaches a bonding position (75) on the conveyor belt (52) within the bonding process station (60), and then is lifted by the fixing device (70). The bonding position (75) is located between the roller (68, 73) and the roller (76, 78), and more accurately, directly below the fixing device (70). Generally, a sucking device is used for the fixing device (70). The first glass sheet (12) is lifted by the fixing device (70) at the bonding position (75).

Then, the second glass sheet (14) passes through between the rollers (68, 73), and simultaneously, the plastic intermediate material (16) is unwound from the feeding roller (64) and moves along the guide rollers (66, 68). When the plastic intermediate material (16) covered with release papers passes through the guide roller (68), the release paper on an underside of the intermediate material (16) is peeled off by the roller (72) so that the coating of the adhesive (18) on the underside of the intermediate material (16) is exposed. That is, the roller (72) serves to peel off the release paper on the underside of the intermediate material (16).

When the coating of the adhesive (18) on the underside of the intermediate material (16) is exposed, the second glass sheet (14) is carried so that the upper surface of the second glass sheet (14) may be attached to the underside of the intermediate material (16). When the second glass sheet (14) passes through between the rollers (68, 73) and reaches the bonding position (75), the upper surface of the second glass sheet (14) is in attachment to the underside of the intermediate material (16). That is, the release paper of the intermediate material (16) is peeled off by the roller (72), and the underside of the intermediate material (16) is attached to the upper surface of the second glass sheet (14), which, in turn, reaches the bonding position (75). At this condition, the second glass sheet with the intermediate material (16) attached thereon has a cross-section consisting of the release paper (not shown), the adhesive (18), the intermediate

then is carried to the cutting process station (84). In the cutting process station (84), the plastic intermediate material (16) is cut. The laminated glass (10) is completed at the cutting process station (84).

The laminated glass (10) passes through the cutting process station (84) and then is carried to the final process station (56). In the final process station (56), the demounting device (86) demounts the laminated glass (10) from the apparatus (50). A conventional mechanism, i.e., a sucking device, is used for the demounting device (86).

In the laminated glass (10) completed by the series of the processes as such, the degree of transparency and the color of the completed laminated glass can be easily adjusted by the intermediate material (16) and the adhesive (18).

Although the above embodiment employs a roller pressing method as a bonding method for the laminated glass, a press-plate pressing method, a vacuum pressing method, an adhesive direct-application pressing method, or the like can be employed, which will be explained in detail hereinafter.

The press-plate pressing method is a method wherein the glass sheets and the intermediate material are located on a predetermined bonding position and then pressed by the press-plate. The size of the press-plate is identical to or greater than that of the corresponding glass sheets, and the pressure applied by the press-plate is adjusted depending on the thickness and size of the glass and the film thickness. As a driving method, hydraulic pressure, pneumatic pressure, a screw, a gear, or the like can be used.

The vacuum pressing method is a method wherein the roller pressing method, the press-plate pressing method, or the like is performed in a vacuum chamber to enhance the effect of pressing.

The adhesive direct-application pressing method is a method wherein an adhesive is directly applied on a glass film by using a sprayer and water is not required since the adhesive is directly applied.

Although the present invention has been described with reference to the above preferred embodiments, it should be understood that any changes or modifications may be made without departing from the scope and spirit of the invention and that they will

	PVB	PET
Environment	Harmful to the environment	Compatible with the environment
Bonding method	Thermal bonding	Adhesive bonding
Ratio of stiffness to weight (assuming that PVB has 1)	1	3 or more
International price ($/ton)	3200 ~ 3500	750 ~ 850
Ability of coloring	Only coloring	Coloring + Printing
Thickness when used as bulletproof glass	46mm or more	26mm

cleaning and drying means for bonding a plastic intermediate material with coatings of adhesives formed on both sides thereof to said second glass sheet;

a fixing device disposed downstream of said dispenser for going up and down in the direction perpendicular to the moving direction of said conveyor belt with said first glass sheet hung on said fixing device and bonding said first glass sheet to said second glass sheet with said intermediate material bonded thereon; and

a pressing means disposed downstream of said fixing device for passing said first and second glass sheets bonded by said fixing device and applying pressure thereto.

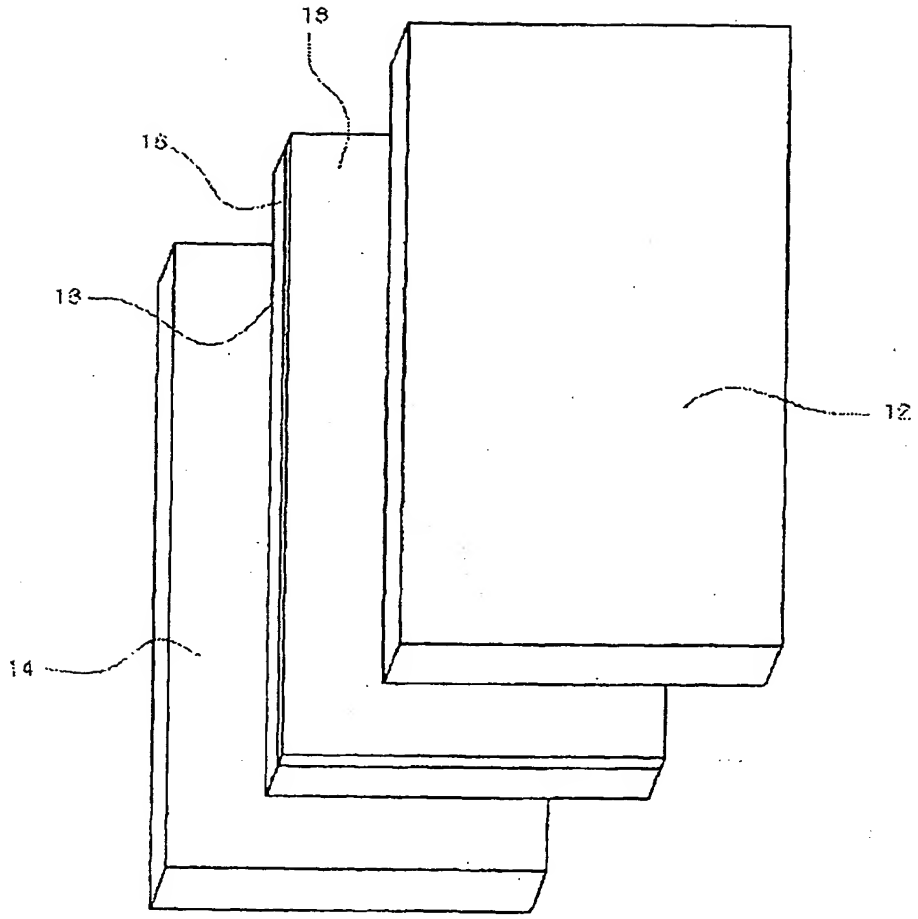

Fig 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR00/00946

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 C03C 27/12, B32B 17/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)
IPC7 C03C

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched
Korean Patents and applications for inventions since 1975
Korean Utility models and applications for Utility models since 1975

Electronic data base consulted during the internationl search (name of data base and, where practicable, search trerms used)
NPS, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 62-052147 A (ASAHI GLASS CO. LTD.) 6 MARCH 1987 See the claims and figures	1, 2
Y	JP 62-278147 A (BRIDGESTONE CORP.) 3 DECEMBER 1987 See the whole document	1
Y	JP 58-079850 A (SEKISUI CHEM. CO. LTD.) 13 MAY 1983	1
A	See the whole document	2
Y	JP 58-190844 A (SEKISUI CHEM. CO. LTD.) 7 NOVEMBER 1983 See the whole document	1
Y	KR 88-700735 A (UCB CO. LTD.) 11 APRIL 1988 See the whole document	1
Y	WO 99-3793 A (SEKISUI CHEM. CO. LTD.) 28 JANUARY 1999 See the claims	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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